



# ESG BRIEFING NOTE

# EXECUTIVE SUMMARY

**Formula 1  
innovation  
is driving our  
sustainability  
strategy**

- Over its 72 year history, the sport of F1 has pioneered numerous technologies & innovations that have positively contributed to society; from ultra-efficient hybrid engines to braking systems that vastly improve safety
- Our engineering excellence is now driving our sustainability strategy and delivery, as we focus on how we can improve our own impact as well as positively influencing the wider global transportation network
- F1 is collaborating with the energy and automotive sectors to be part of the solutions which will play a critical role in the future of mobility – from sustainable fuels to electric vehicle technology

Pages 3 - 8

**To develop  
solutions  
to global  
transportation  
challenges**

- The World Motorsport Council has agreed clear objectives for the 2026 Technical Regulations with the aim of delivering a powerful environmental message and a significant cost reduction, whilst protecting the show and maintaining F1 as the pinnacle of motorsport
- As part of our 2030 Net Zero goal, F1 is committed to powering cars with 100% Advanced Sustainable Fuels, creating a viable, low CO<sub>2</sub> emissions, high-performance alternative to incumbent diesel and gasoline fuels
- Sustainable fuels have a clear role to reduce the environmental impact of all new and existing Internal Combustion Engine (ICE) based road-cars globally, with further potential to decarbonise heavy road transport, shipping and aviation
- Alongside the development of Advanced Sustainable Fuels, F1 will be advancing the capability of battery technologies as part of the F1 Hybrid Powertrain, which are critical to the sustainable growth of the Electric Vehicle (EV) market

Pages 9 - 14

**While  
building a  
sustainable  
foundation for  
our business**

- In 2019, Formula 1 (the commercial rights holder of the FIA Formula One World Championship) announced a comprehensive Sustainability Strategy, focusing on areas where we have greatest environmental & social impact
- Throughout the pandemic, Formula 1 has continued to make progress across all three Environment, Social & Governance (ESG) pillars
- In 2022, Formula 1 will continue to make progress towards its Net Zero goal and will focus on supporting Race Promoters with detailed sustainability guidance to help leave a legacy of positive change wherever we race

Pages 15 - 21

The uniqueness of F1 is the intense competition to win by engaging thousands of top engineers to find better solutions. By shaping the regulations and direction of the competition, we can have a win-win situation, building a fantastic sport and driving invaluable technologies for the future

# FORMULA 1 INNOVATION IS DRIVING OUR SUSTAINABILITY STRATEGY

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For 72 years F1 has been at the forefront of engineering innovation, pioneering technologies that have been widely adopted by the global transport sector

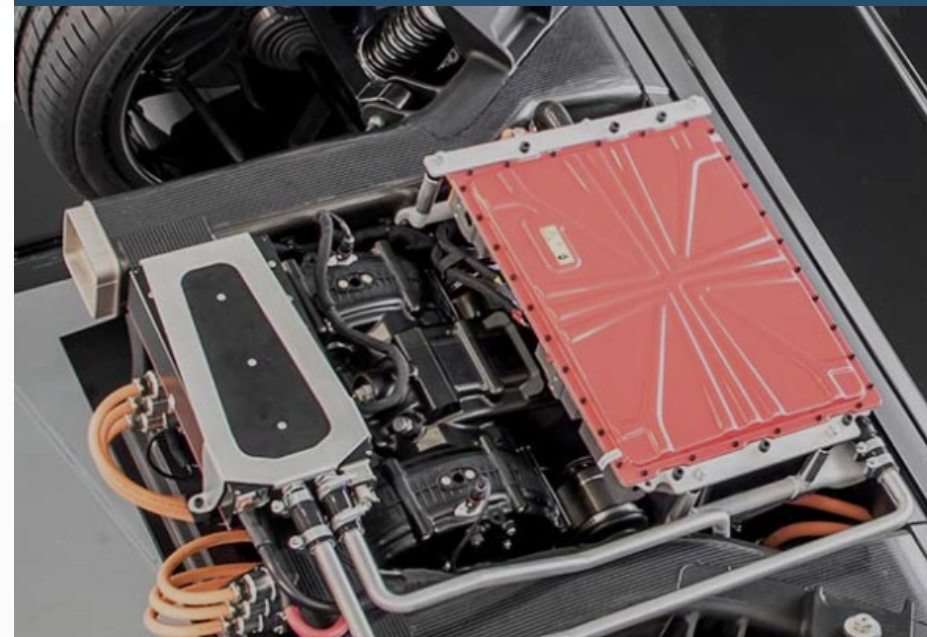
Intense competition on track and the relentless pursuit for improved performance are the driving forces behind F1's success.

	Hybrid Power Unit technology	Vehicle energy management	Light weight materials	Ultra-fast development cycles
Examples of Current F1 Tech	F1's Hybrid Power Unit combines ultra-lean Internal Combustion Engines (ICEs) with high-efficiency electrical machines to deliver over 50% thermal efficiency (avg. road car =30-35%)	Real-time optimisation of energy recovery & deployment systems alongside advanced battery management delivers maximum power and faster lap times	Development of advanced composite materials such as carbon fibre, combined with rapid structural modelling techniques underpin F1's legendary focus on weight reduction	Advanced Computational Fluid Dynamics (CFD), vehicle & electrical systems modelling and real-time data simulations enable ultra-fast development cycles and support complex multi-stage manufacturing and delivery processes
Industry relevance	Plug-in Hybrids represent c36% of all electric vehicles models in 2020 <sup>1</sup> and will play a key role in decarbonising transport. F1 technology is enabling faster battery charging and improved ICE fuel efficiency	Automotive OEMs have directly applied F1 energy management technologies to optimise energy use and battery management, delivering improved efficiency and performance across their hybrid/EV vehicle fleets	Advanced materials are essential for boosting the fuel economy of modern vehicles while maintaining safety and performance, where a 10% reduction in vehicle weight can result in a 6%-8% fuel economy improvement <sup>2</sup>	These techniques have been applied by automotive OEMs and other major industries to enable accurate, flexible and reactive engineering development – bringing low emissions vehicles to market in a fraction of the time of previous models
Examples	<a href="#">Mercedes EQ Power</a>	<a href="#">Renault Hybrid E-Tech</a>	<a href="#">US Department for Energy</a>	<a href="#">Jaguar iPace CFD</a>

1. [International Energy Agency](#) 2. [US Department for Energy](#)

Underpinned by billions of dollars of investment F1 has spearheaded the rapid design and development of cutting-edge technologies that have improved the safety, performance and efficiency of everyday vehicles

**WAE EVX Platform**



**F1 Flywheel hybrid**



**McLaren Applied  
Inverters, Batteries, ECUs**



**Maserati passive  
pre-chamber**



**Renault energy  
management**



**Garrett eTurbo**



**BMW i3 carbon fibre  
chassis**



**Jaguar iPace CFD  
methods**



F1's 2026 Technical Regulations are planned to support the advancement of low-carbon fuels, electric batteries & autonomous vehicle technology - playing a critical role in all aspects of the future of mobility

### Building a sustainable foundation for our business

As part of our Sustainability Strategy, we have a 2030 Net Zero goal which includes our own operations in addition to F1 teams and Race Promoters who host our events.

Our own carbon footprint showcases the importance of global transport applicability.

- Like many organisations, our carbon footprint is largely driven by travel and logistics which make up over 72% of our baseline footprint<sup>1</sup>.
- Racing fuel represents less than 1% of total emissions, but is the area where F1 could have the greatest multiplier effect on the global transportation sector.

F1's 2026 Technical Regulations are being specifically designed to support the growth of road-relevant technologies and will influence the considerable value of R&D and innovation spend of the F1 Teams and their OEM parents

### Developing solutions for global transportation challenges

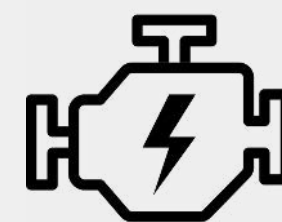
## F1 2026 ENGINE & FUELS STRATEGY

2026 Technical Regulations will underline F1's position at forefront of automotive technology



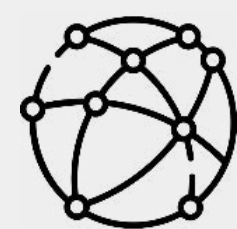
#### Hybrid engines powered by 100% Advanced Sustainable Fuels

F1 is working intensively alongside fuel companies to push the development of 100% advanced sustainable drop-in fuels which have the potential to significantly reduce emissions from all existing ICE based vehicles. Find more details about the science behind sustainable fuels in the [appendix](#)



#### Advanced Hybrid engine with increased electrification

The plans for the next generation 2026 F1 hybrid power unit aim to derive considerably more of its energy from electrical power with plans for the future regulations to also restrict use of unsustainable materials in battery production



#### Cutting-edge telemetry and connectivity

Vehicle-to-vehicle (V2V) & Vehicle-to-Infrastructure (V2I) connectivity that will be backbone of autonomous vehicle infrastructure in future

By defining a sustainable & relevant Formula for F1 we can secure the ongoing success of Formula 1 and continue to attract a new generation of fans, partners and suppliers



### OEM participation

- 2026 Sustainable Fuels & Hybrid Engine strategy is supported by all current OEMs & is critical to their continued investment & attractiveness of sport to new OEMs

### Attractiveness to partners

- With 23 races in 21 countries and a cumulative TV audience of c.1.5bn, F1 is an attractive platform for commercial partners to elevate their brands
- The launch of Formula 1's Sustainability Strategy has significantly increased the sport's attractiveness and created new partnership opportunities for both Formula 1 and the F1 Teams

### Engagement of fans

- 75% of fans feel Formula 1's sustainability plan is important for the longevity of the sport
- 65% of fans view F1 more positively due to our Sustainability Strategy

### Alignment of fuel suppliers

- The main objective of the 2026 Technical Regulations is to have all F1 Teams power their cars with 100% Advanced Sustainable Fuels
- This will create a global platform for fuel suppliers to showcase this new technology which has a wide range of industry applications
- There is growing consensus among regulators, automotive/aviation execs and fuel industry leaders that sustainable liquid fuels will play a key role, alongside electrification, in achieving Net Zero goals for passenger, road freight, aviation and maritime transport



As we continue to deliver against our ambitious Sustainability Strategy

## COUNTDOWN TO ZERO

ACCELERATE TECHNOLOGIES THAT  
DECARBONISE THE WORLD

**BY 2030**

**NET ZERO CARBON FOOTPRINT  
FROM FACTORY TO FLAG**

### ON THE TRACK

Sustainably-fuelled hybrid  
race cars

### ON THE MOVE

Ultra efficient & low/zero carbon  
logistics & travel

### WHERE WE WORK

100% renewably powered offices,  
facilities and factories

### BALANCE TO ZERO

Credible offsets and breakthrough  
CO<sub>2</sub> sequestration programs

## POSITIVE RACE PRINT

LEAVE A LEGACY OF POSITIVE CHANGE  
WHEREVER WE RACE

**BY 2025**

**EVERY RACE TO QUALIFY AS AN F1  
SUSTAINABLE SPECTACLE**

### WHAT WE USE

Sustainable materials with all waste  
re-used, recycled or composted

### TO THE RACE

Incentives and tools to offer every fan  
a greener way to reach the race

### WHERE YOU WATCH

Circuits and facilities that are better for  
fan wellbeing and nature

### WITH OUR HOSTS

Opportunities for local people and causes  
to get in on the action

## WAVE OF CHANGE

UNLEASH THE POWER OF DIVERSITY  
THROUGH OUR SPORT

**BY 2025**

**ALL ASPECTS OF OUR SPORT REFLECT  
THE WORLD IN WHICH WE RACE**

### BACK AT BASE

Championing a culture of inclusion and  
creating a diverse talent pool within F1

### IN THE CLASSROOM

Education initiatives that inspire young  
people to pursue a future in STEM

### BEHIND THE VISOR

Removing barriers and empowering  
diverse talent to rise

### TO THE WORLD

Active promotion of diverse talent and  
inclusive content across our media

**GOVERNANCE  
FOUNDATIONS**

HUMAN  
RIGHTS

ETHICAL  
CONDUCT

RESPONSIBLE  
SOLUTIONS

TRANSPARENCY  
& REPORTING

HEALTH  
& WELLBEING

ENVIRONMENTAL  
COMPLIANCE

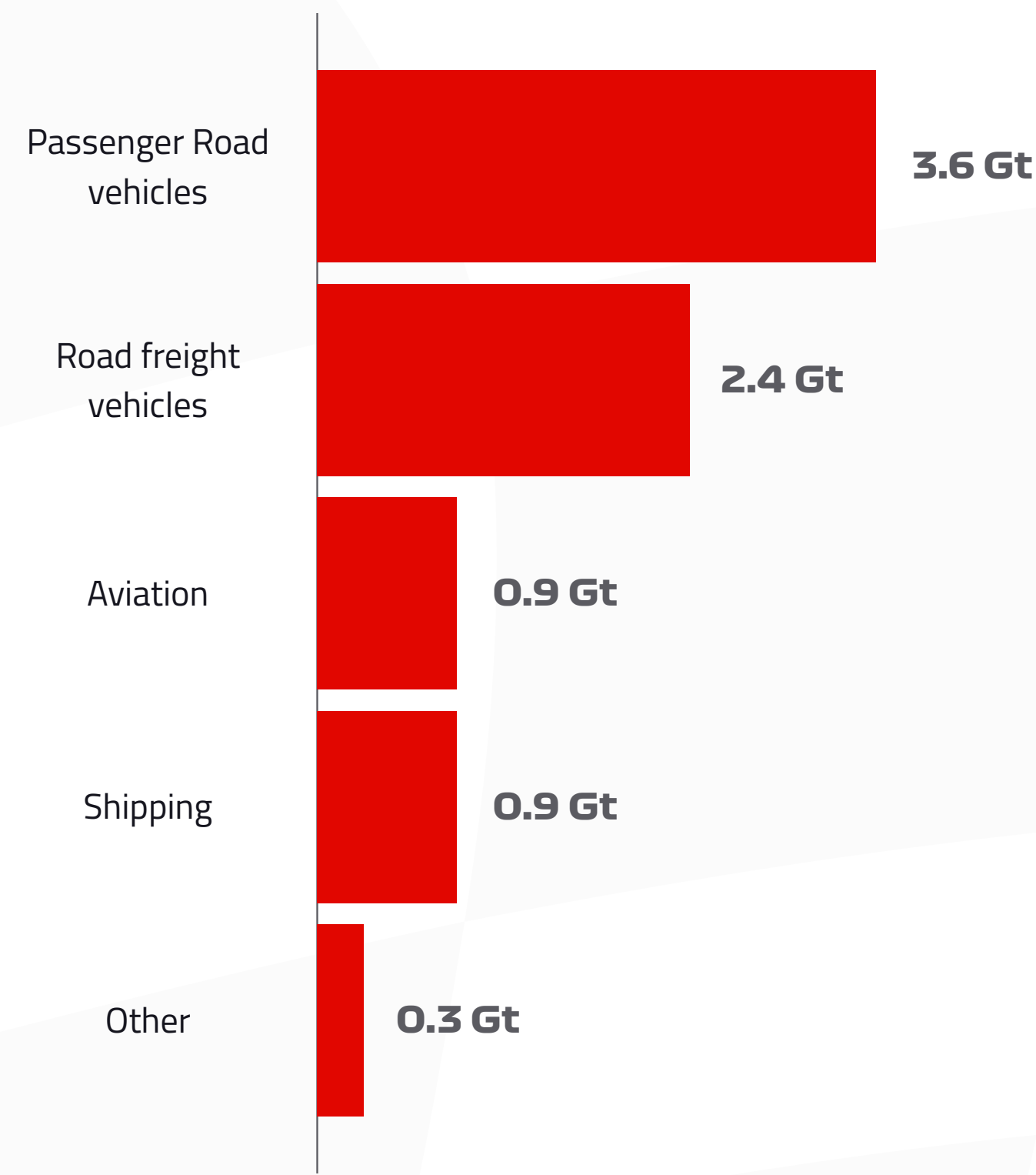


# **TO DEVELOP SOLUTIONS TO GLOBAL TRANSPORTATION CHALLENGES**

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With the increasing urgency to decarbonise the global transport sector, multiple technologies will be required to sufficiently reduce GHG emissions - with sustainable fuels making a material contribution

**In 2018, the global transport sector contributed c. 8Gt CO<sub>2</sub><sup>1</sup> to global emissions (c.14% of total GHG emissions)<sup>2</sup>**



**There are a number of challenges to decarbonise transport emissions, which need to fall to 5.7Gt by 2030 to reach Net Zero by 2050<sup>3</sup>. Sustainable fuels create a viable, low CO<sub>2</sub> emissions, high-performance alternative that can address the challenges facing the transport industry**

### Challenges of decarbonising the transport sector

- IEA forecasts Electric Vehicles (EVs) will represent 145m-230m (7-12%) of total vehicle stock by 2030
- Existing battery technology does not have the energy density required for the transport sector's most challenging abatement areas
- Current fossil based fuels emit significant amounts of CO<sub>2</sub> contributing to climate change
- Life-cycle analysis shows high associated emissions with EV production driven by battery manufacture
- Significant capital investment & time required to build energy distribution, storage & charging infrastructure
- **Global reliance on internal combustion engines is likely to persist for several decades to come**

### Benefits of advanced sustainable fuels

- Sustainable fuels could help to decarbonise the existing global car parc of over >1bn cars as well as any new ICE-based vehicles produced
- Sustainable fuels have the potential to decarbonise the entire transportation industry inc. heavy goods vehicles, shipping and aviation
- CO<sub>2</sub> reduction potential of sustainable fuels is 85–96% (Wheel-To-Tank) or 70% (life-cycle analysis)<sup>4</sup>
- Life-cycle analysis indicates a sustainably fuelled hybrid could produce lower emissions than EVs
- Sustainable fuels use existing infrastructure, significantly reducing high capital investment costs
- **The development and deployment of sustainable fuels is essential for meeting global decarbonisation goals**

Sustainable fuels have particular applicability on the largest emitting sectors of heavy road transport, shipping and aviation, which have a lower electrification potential with current technologies

### Comparisons and suitability of different energy sources and vehicle types based on energy density infrastructure requirements

Vehicle and duty cycle compatibility <sup>1</sup>		Synthetic E-fuels	Hydrogen	Electricity
Automotive	City Car	Green	Green	Green
	Long Distance Car	Green	Green	Light Green
	Urban Van	Green	Green	Green
	Heavy Goods Vehicle	Green	Orange	Orange
Aviation	Short Haul	Green	Orange	Orange
	Long Haul	Green	Red	Red
Marine	Short Haul	Green	Light Green	Green
	Long Haul	Green	Orange	Red
Infrastructure challenges	Distribution	Green with H <sub>2</sub> icon	Red with H <sub>2</sub> icon	Orange with H <sub>2</sub> icon
	Refuelling	Green with fuel pump icon	Orange with fuel pump icon	Orange with fuel pump icon

Fully compatible	<span style="color: green;">■</span>	Minor restrictions	<span style="color: lightgreen;">■</span>
Major restrictions	<span style="color: orange;">■</span>	Sever restrictions	<span style="color: red;">■</span>

#### An industry wide alternative

- Complete efficient electrification is unlikely to be feasible for areas such as shipping, or aviation or even heavy road transport in the medium term
- Synthetic fuels have the potential to be fully compatible throughout the entire transportation industry

#### A combined solution

- The sustainable future of the transportation sector will require a combined effort of propulsion system adoption, with synthetic fuels, hydrogen and electric all playing a vital role

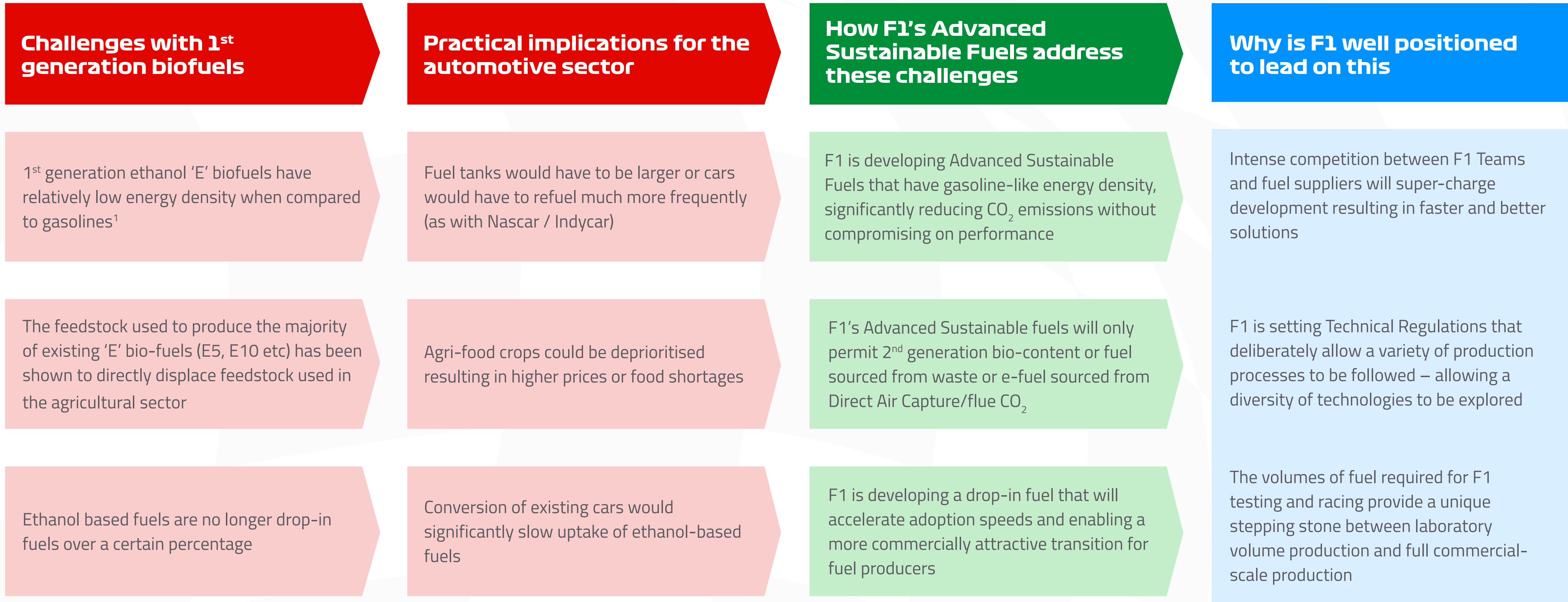
#### Infrastructure challenges

- The current distribution and refuelling challenges associated with hydrogen and electric restricts their adoption into the transportation industry in the short-medium term when compared to synthetic fuels
- The 'drop-in' feature of synthetic fuels also bypasses the need for complex and expensive vehicle modifications of the current and future global car parc

1. Royal Society

# F1 is leading the automotive sector to develop an Advanced Sustainable Fuel while tackling existing drawbacks to 1st generation biofuels

**The sustainable fuel market is currently dominated by 1<sup>st</sup> generation biofuels. F1 is accelerating the development and deployment of 2<sup>nd</sup> generation biofuels and synthetic eFuels (Advanced Sustainable Fuels)**

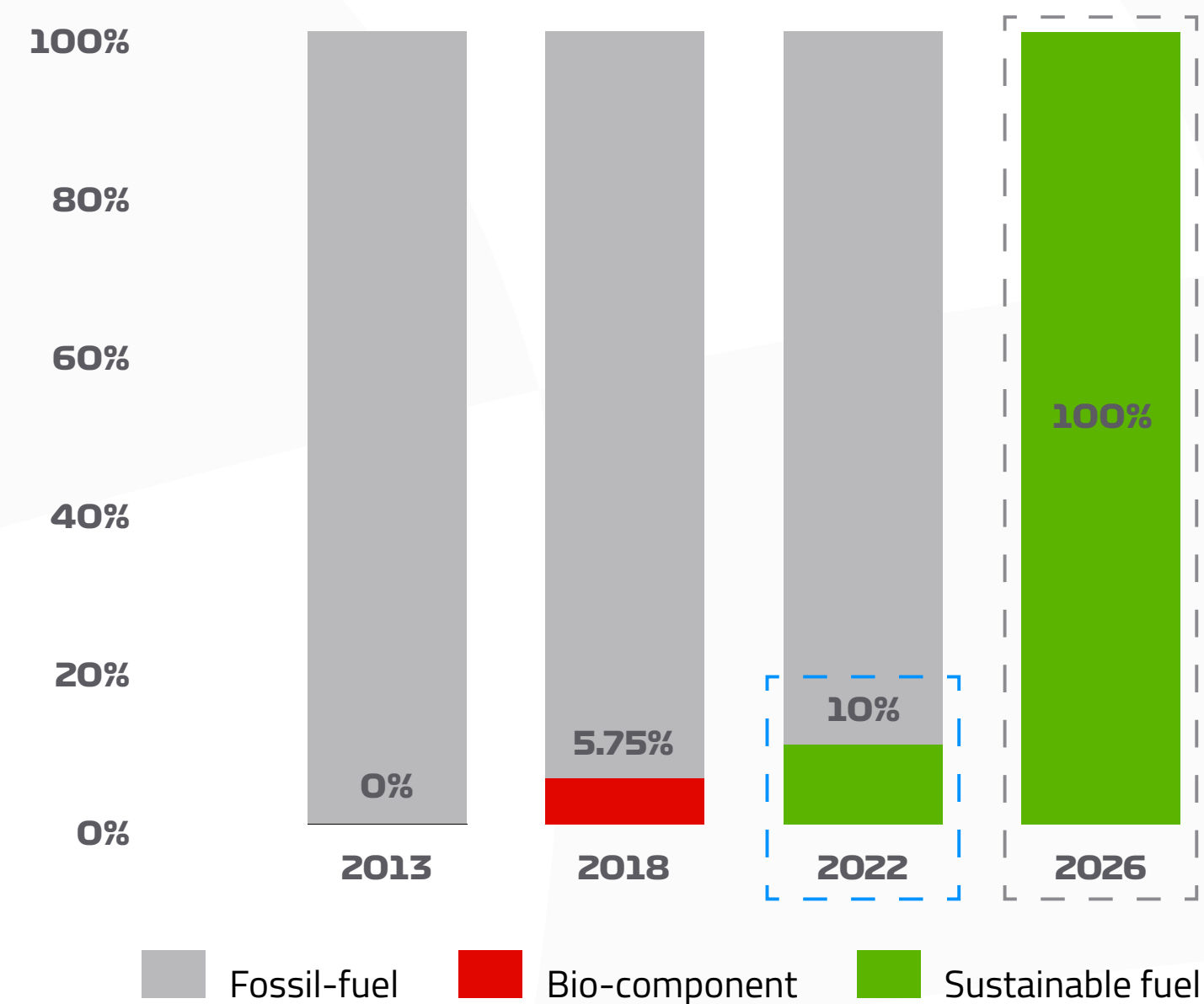


1. Royal Society

F1's future fuels are being developed in collaboration with the major automotive OEMs and F1 fuel partners, galvanizing support of the key automotive industry players for this critical technology

To support the development and implementation of Advanced Sustainable Fuels, F1 has set an ambitious target that by 2026 all F1 teams competing in the Championship will be required, by regulation, to power their cars with 100% Advanced Sustainable Fuels

### Historical performance and future adoption in F1 of Advanced Sustainable Fuel



- E10 fuel – 10% renewable ethanol and 90% fossil fuel mixture
- High performance 2<sup>nd</sup> generation or synthetic fuel
- Certified by a credible biofuel certification scheme
- Drop-in characteristics

### Action Plan

- **2022:** Research of surrogate fuel candidates in single cylinder engine
- **2023:** Adoption of fully sustainable fuel in Formula 2 and Formula 3
- **2024/25:** Development of next generation F1 power unit with fully sustainable fuel
- **2026:** Adoption of fully sustainable fuel yielding greater than 65% GHG remission reduction

### How F1 is working with our partners

- Aramco introducing 2 pilot plants to produce Advanced Sustainable Fuel
- F1 development fuel testing funded by Aramco
- FIA commissioned IFP (French Institute of Petroleum) to produce 1000 litres of sustainable fuel for testing
- F1 is supporting modelling research and development of sustainable fuels with implementing partners

### Technical Regulations

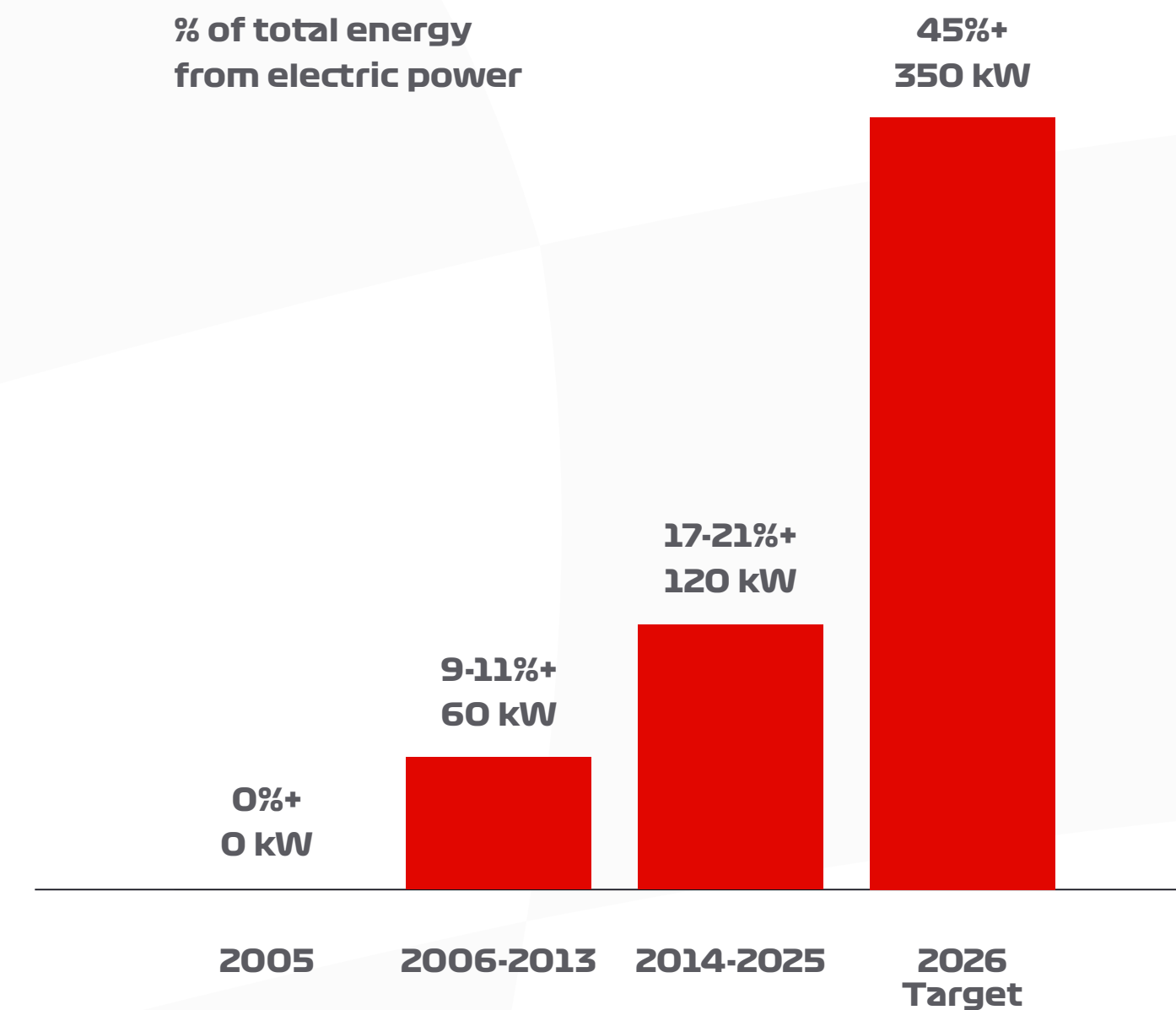
The Technical Regulations will:

- Define the exact specifications and parameters of competing cars – with strict adherence monitored and enforced by the FIA
- Specify characteristics that increase road-relevance (e.g. octane limits, fuel energy content, density and composition)
- Allow freedom in production methods – encouraging alternative sustainable fuel development routes

In conjunction with the development of sustainable fuels, F1 will also be advancing the capability of battery technologies, which are critical to the sustainable growth of the Electric Vehicle (EV) market

To support the acceleration of electric vehicle technology, F1 has set an ambitious target that by 2026 all F1 teams competing in the Championship will be required, by regulation, to run power units that derive almost 3x as much power from electrical sources compared to the current power unit

### Amount of power derived from electrical sources in F1 power units



### F1 leadership

#### F1 Teams to improve battery technology

- ✓ Lighter
- ✓ Higher-energy
- ✓ Improved power density
- ✓ Advanced battery management systems
- ✓ Limiting use of certain high risk materials (eg. cobalt)<sup>1</sup>

### Action Plan

- **2022:** Study of vehicle parameters to enable almost 3x the amount of energy to come from electrical system
- **2023:** Study of sustainability of electrical machines and energy stores leading to regulatory constraints on non-sustainable materials
- **2024/5:** Development of next generation hybrid systems
- **2026:** Adoption of ultra-high power, ultra-high energy hybrid system in racing

### Technical Regulations

The Technical Regulations imposed on the sport requires compliance of all F1 teams, encouraging the need for innovative developments

1. [US Department of Energy](#)

# WHILE BUILDING A SUSTAINABLE FOUNDATION FOR OUR BUSINESS

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Throughout the pandemic, Formula 1 has continued to make progress against the goals of its Sustainability Strategy

## COUNTDOWN TO ZERO



### Remote broadcast operations

In 2020 we introduced remote broadcast operations, delivering a 34% reduction in technical cargo which continued into 2021



### Streamlined logistics

F1 is replacing existing shipping containers with AMJ Unit Load Devices enabling the reduction in use of high-emission, ageing 747s for air freight movement

## POSITIVE RACE PRINT



### Plastics reduction

In 2021 all 10 F1 Teams significantly reduced use of single use plastic bottles in the Pit and Paddock

### Promoter guidance

In 2022, F1 provided race promoters with a detailed Sustainability guidance document to help support delivery of more sustainable events

## WAVE OF CHANGE



### W Series partnership

In 2021 the W Series became an official F1 support race, and will race at eight F1 events in 2022



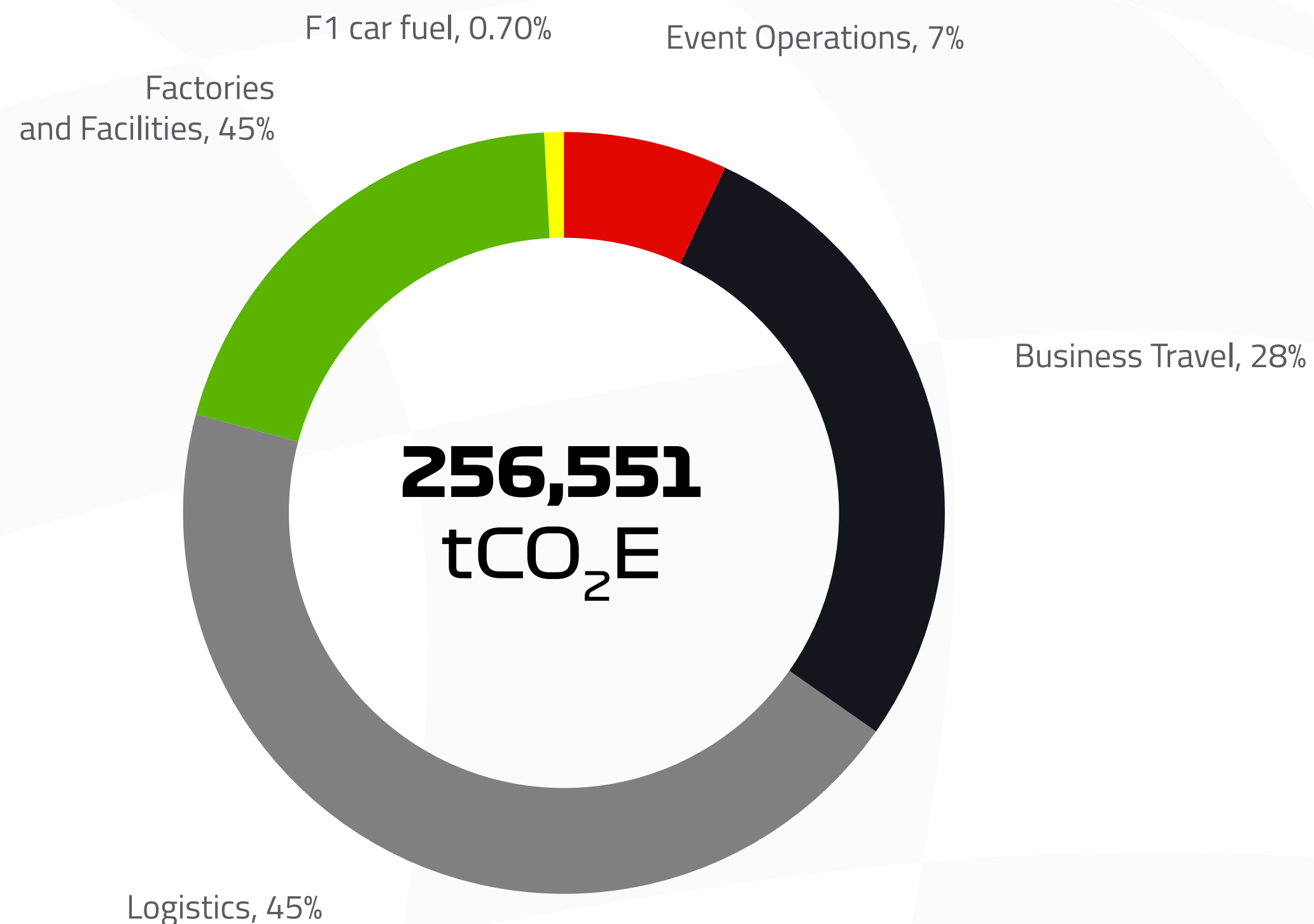
### F1 Scholarships

In 2021 a fully-funded scholarship programme launched for 10 students across UK and Italy. F1 has committed to extend this programme to 2025



At the core of our strategy is an ambitious plan to achieve Net Zero Carbon by 2030, significantly reducing the emissions of Formula 1 and those created by the wider F1 community

### Formula One World Championship - 2018 Baseline



- Whilst racing fuel represents less than 1% of total emissions, it is the area where F1 could have the greatest multiplier effect on the global transportation sector
- We have a detailed roadmap in place to systematically reduce our Scope 1, 2 and 3 emissions, sending less equipment to races via remote operations and enabling the adoption of lower-impact transportation methods
- 2018 will be the designated baseline year for F1's GHG emissions and any future related reduction targets. For reference, GHG emissions amounted to 155,104 tCO<sub>2</sub>e in 2020 which was significantly impacted by the COVID pandemic and thus should not be considered as a comparable year
- >98% of the total emissions are Scope 3, with only 27% directly controlled by Formula 1 & the balance driven by the wider F1 community such as teams and race promoters
- Formula 1 will continue to update its baseline in line with the latest standards. We are currently reviewing how fan travel can be incorporated to ensure that we are accurately reflecting the carbon footprint of F1 as a wider sport

To track progress, Formula 1 annually undertakes an independently calculated carbon footprint assessment based on the accounting and reporting procedure as per the Greenhouse Gas Protocol (GHGP). Please see our [website](#) for our latest figures.

Formula 1 continued to make progress towards its goal of becoming net zero by 2030 while facilitating F1's development of technologies that can contribute to the decarbonisation of the world

<b>COUNTDOWN TO ZERO</b>	<b>Achieved</b>	<b>In progress/Future plans</b>
<b>ON THE TRACK</b> Sustainably-fuelled hybrid race cars	<ul style="list-style-type: none"> <li>✓ Bio-component in fuel increased to 10% for 2022, increased from 5.75% in 2021</li> <li>✓ Over 50% thermally efficient hybrid with kinetic and heat energy recovery systems</li> <li>✓ Agreement from all participating F1 Teams and fuel suppliers for adoption of 100% Advanced Sustainable Fuels</li> </ul>	<ul style="list-style-type: none"> <li>▪ Ongoing development of Advanced Sustainable drop-in Fuels, to be used in 2026, is at the second stage of surrogate testing</li> </ul>
<b>ON THE MOVE</b> Ultra efficient & low/zero carbon logistics & travel	<ul style="list-style-type: none"> <li>✓ Accelerated delivery of Remote Broadcast Operations resulting in a 34% reduction in broadcast freight</li> <li>✓ Formula 1's innovative honeycomb design for the walls of its travelling Broadcast Centre reduces weight and GHG emissions from freight</li> </ul>	<ul style="list-style-type: none"> <li>▪ F1 is replacing existing shipping containers with AMJ Unit Load Devices enabling the reduction in use of high-emission, ageing 747s for air freight movement</li> <li>▪ Increased use of sea freight for non-essential racing equipment"</li> </ul>
<b>WHERE WE WORK</b> 100% renewably powered offices, facilities and factories	<ul style="list-style-type: none"> <li>✓ 100% renewable electricity for all its UK offices (guaranteed through a Power Purchase Agreement)</li> <li>✓ 100% biofuel natural gas at the Formula 1 Media and Technology Centre</li> <li>✓ Albert certified carbon neutral broadcast production of 2021 British Grand Prix</li> </ul>	<ul style="list-style-type: none"> <li>▪ Continued transition from Diesel to Hydrotreated Vegetable Oil (HVO) in core broadcasting generators at a number of races in 2021</li> <li>▪ Commitment to renewable energy sources at a number of circuits, with Bahrain targeting a 100% renewably-powered Grand Prix in 2022</li> </ul>
<b>BALANCE TO ZERO</b> Credible offsets and breakthrough CO <sub>2</sub> sequestration programs	<ul style="list-style-type: none"> <li>✓ Detailed roadmap to reduce absolute emissions by &gt;45% reduction by 2030</li> <li>✓ Technologies pioneered by F1 Teams have been central to reducing emissions of other industries</li> </ul>	<ul style="list-style-type: none"> <li>▪ Offset all unavoidable emissions through a mix of biological and technological sequestration activities to achieve its 2030 Net Zero target</li> </ul>

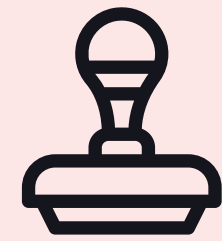
Formula 1 advanced on its mission to leave a legacy of positive change, enriching local communities and economies, and supporting the natural environment

<b>POSITIVE RACE PRINT</b>	<b>Achieved</b>	<b>In progress/Future plans</b>
<p><b>WHAT WE USE</b> Sustainable materials with all waste re-used, recycled or composted</p>	<ul style="list-style-type: none"> <li>✓ Over 140,000 recycled plastic bottles used to make all Formula 1 staff, team, media and fan accreditation passes in 2021</li> <li>✓ BWT signed as Official Water Technology Partner bringing expertise in water treatment and filtration to help deliver our commitment to reduce our reliance on single-use plastics</li> <li>✓ Increased food recycling across our Grand Prix races in 2021 (e.g. at Silverstone where over 1.9 tonnes of leftover food was donated to a local foodbank)</li> </ul>	<ul style="list-style-type: none"> <li>▪ 100% of all waste will be reused, recycled or composted by 2025</li> <li>▪ Continue to work with promoters to expand infrastructure and facilities to deliver F1 goals</li> </ul>
<p><b>TO THE RACE</b> Incentives and tools to offer every fan a greener way to reach the race</p>	<ul style="list-style-type: none"> <li>✓ Promoters have introduced additional public transport services as well as cycling and car pooling incentives (e.g. Zandvoort where 25,000 spectators travelled to the circuit by bicycle with a further 40,000 arriving by public transport)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Exploring tools that would allow fans to elect to offset the carbon footprint of their travel when purchasing tickets</li> </ul>
<p><b>WHERE WE WATCH</b> Circuits and facilities that are better for fan wellbeing and nature</p>	<ul style="list-style-type: none"> <li>✓ Introduction of 'green spaces' and improved biodiversity at some circuits</li> <li>✓ Ongoing focus on fan welfare and safety when running F1 events during COVID pandemic</li> </ul>	<ul style="list-style-type: none"> <li>▪ Healthy food options and access to free water to be offered to fans at all races by 2025</li> <li>▪ All circuits to have biodiversity plan in place by 2025 (where relevant)</li> </ul>
<p><b>WITH OUR HOSTS</b> Opportunities for local people and causes to get in on the action</p>	<ul style="list-style-type: none"> <li>✓ STEM-based programmes allow students to access the races for free during the race week in multiple races</li> <li>✓ Strong focus on local job creation and temporary staff hiring</li> </ul>	<ul style="list-style-type: none"> <li>▪ Build partnerships that give local people greater access to our Events and that drive positive benefits for local business and causes by 2025</li> </ul>

Formula 1 has taken steps to build a more diverse and inclusive sport by removing barriers, nurturing talent, and inspiring change

WAVE OF CHANGE	Achieved	In progress/Future plans
<p><b>BACK AT BASE</b> Championing a culture of inclusion and creating a diverse talent pool within F1</p>	<ul style="list-style-type: none"> <li>✓ Internship and apprenticeship placement opportunities within Formula 1, following close liaison with leading organisations BCOMS and The Blair Project</li> <li>✓ To ensure safeguards in salary review processes, we are continuously monitoring pay gaps across different demographics</li> </ul>	<ul style="list-style-type: none"> <li>▪ Redefine hiring processes, interview processes and HR touchpoints for all candidates</li> <li>▪ All staff will undergo mandatory Diversity &amp; Inclusion training to ensure unconscious bias plays no part in our recruitment practices</li> </ul>
<p><b>IN THE CLASSROOM</b> Education initiatives that inspire young people to pursue a future in STEM</p>	<ul style="list-style-type: none"> <li>✓ Introduced Formula 1 Scholarships programme – supporting underrepresented students in the UK and Italy</li> <li>✓ Continued global expansion of the F1 in Schools programme, with Miami being the latest addition</li> </ul>	<ul style="list-style-type: none"> <li>▪ Formula 1 Scholarships programme extended until 2025</li> <li>▪ Development STEM-based, on-demand, free-to-use educational modules</li> </ul>
<p><b>BEHIND THE VISOR</b> Removing barriers and empowering diverse talent to rise</p>	<ul style="list-style-type: none"> <li>✓ In 2021 the W Series became an official F1 support race, and will race at eight events in 2022</li> </ul>	<ul style="list-style-type: none"> <li>▪ Identifying parallels between virtual and physical driving, exploring the ability to develop Esports as an affordable and accessible pathway</li> </ul>
<p><b>TO THE WORLD</b> Active promotion of diverse talent and inclusive content across our media</p>	<ul style="list-style-type: none"> <li>✓ Increased diversity of our presenter line-up</li> </ul>	<ul style="list-style-type: none"> <li>▪ Target locally relevant talent at each of the races</li> </ul>

## Formula 1 is continuing to build strong foundations, particularly in business ethics



As a material subsidiary of Liberty Media, a US public company, Formula 1 is required to comply with **Sarbanes–Oxley Act**



Signatory of the **United Nations' Sports for Climate Action Framework**



Formula 1's **Code of Conduct**, underlying policies and compliance procedures ensure that business is carried out ethically and in compliance with applicable laws



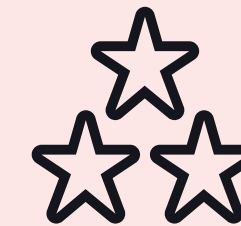
Formula 1's **Compliance Department** reports into the Chief Legal Officer and Chief Administration Officer, who sits on the Risk & Compliance Committee together with senior executives from Liberty Media



Personnel receive regular **Compliance training** and are required to complete face to face and online e-training on various topics covered by the Code of Conduct<sup>1</sup>



F1 has a process for reporting ethical concerns and a speak up **confidential hotline**



Rated best practice (3 star) by FIA **Environmental Accreditation** Programme



Targeting **ISO 20121** (Sustainable Events) accreditation in 2022

1. e.g. anti-bribery and anti-corruption, anti-trust/anti-competitive practices, data privacy, and health & safety

# **APPENDIX A. THE SCIENCE BEHIND SUSTAINABLE FUELS**

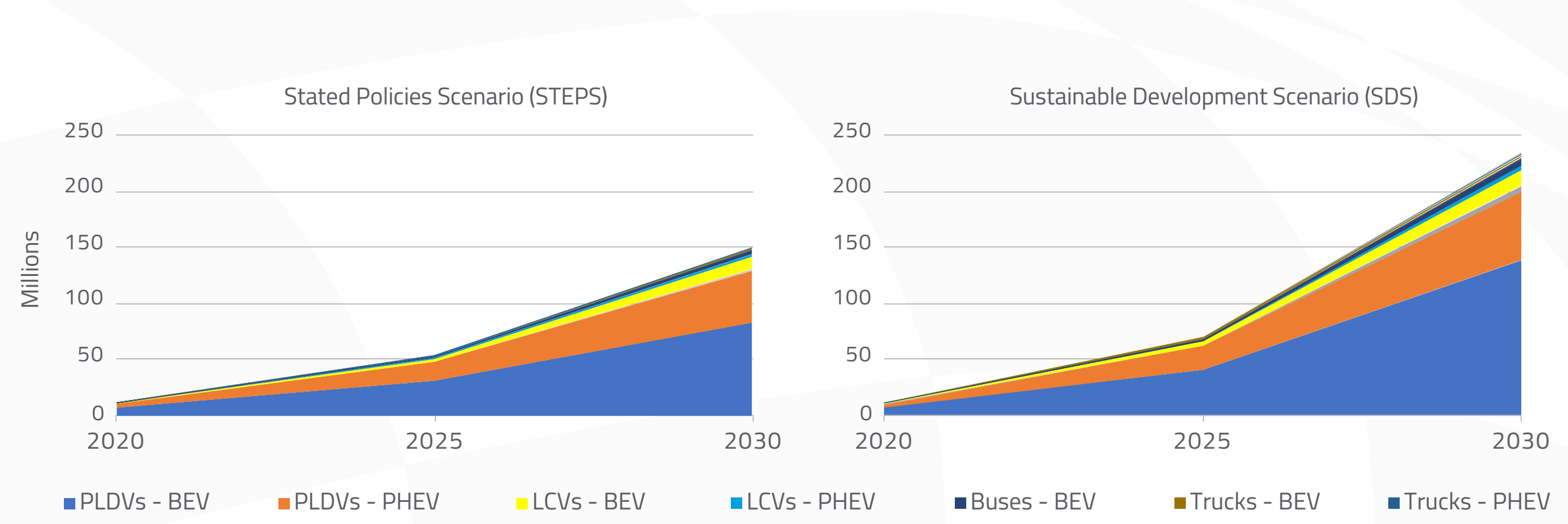
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# GLOSSARY

Term	Definition
<b>1st Generation Bio-fuels</b>	First-generation biofuels are fuels made from food crops grown on arable land. The crop's sugar, starch, or oil content is converted into biodiesel or ethanol, using transesterification, or yeast fermentation.
<b>2nd Generation Bio-fuels</b>	Second-generation biofuels are fuels made from lignocellulosic or woody biomass, or agricultural residues/waste. The feedstock used to make the fuels either grow on arable land but are byproducts of the main crop, or they are grown on marginal land.[11] Second-generation feedstocks include straw, bagasse, perennial grasses, jatropha, waste vegetable oil, municipal solid waste and so forth
<b>Advanced Sustainable Fuels</b>	An Advanced Sustainable Fuel made up of Advanced Sustainable (AS) Components that are derived from an approved carbon capture scheme or from municipal waste or from non-food biomass that achieves a GHG saving of at least the level of the current European Renewable Energy Directive
<b>AMJ ULD</b>	Unit Load Devices are containers which are loaded onto cargo or passenger aircraft built to a specific dimensions and contours dependent on the aircraft
<b>Biofuel</b>	Fuels produced through biomass rather than fossil fuels
<b>Biomass</b>	A renewable energy source which is generated from wood, plants and other organic matters including waste
<b>CFD</b>	Computational fluid dynamics (CFD) is a branch of fluid mechanics that uses computer based numerical analysis and algorithms to simulate, analyze and solve problems in fluid flow
<b>Drop-in fuels</b>	Fuels which mimic most properties of existing gasolines which can therefore be used in existing internal combustion engine hardware
<b>Energy density</b>	Energy density is the amount of chemical energy stored for a given amount of fuel. It might be the amount of energy per kg (gravimetric energy density) or the amount of energy per litre (volumetric energy density).
<b>Hybrid technologies</b>	Technology utilising two or more types of power (e.g. electric motor and an internal combustion system) for better overall energy efficiency
<b>ICE based vehicles</b>	Vehicles powered by an Internal Combustion Engine
<b>LCA</b>	Life cycle analysis (LCA) is a method used to evaluate the environmental impact of a product through its life cycle encompassing extraction and processing of the raw materials, manufacturing, distribution, use, recycling, and final disposal.
<b>OEM</b>	Original Equipment Manufacturers that produce parts and equipment which are then used as components in the products of another company
<b>V2I Connectivity</b>	Vehicle to Infrastructure connectivity enables vehicles to share information with a variety of smart devices within road infrastructure (e.g. cameras, traffic lights and lane markings) to improve safety
<b>V2V Connectivity</b>	Vehicle-to-Vehicle connectivity enables communication between vehicles to alert of speed, location and direction for safety measures

Electric vehicles will only represent 7-12% of the global car parc by 2030, therefore the development of sustainable fuels for ICEs will be essential to meet climate goals

### Global EV stock by mode and scenario, 2020-2030<sup>1</sup>



- In the IEA’s Global EV Outlook 2021, they estimate EV stock across all modes could reach 145m (Stated Policies Scenario) -230m (Sustainable Development Scenario) vehicles by 2030, accounting for 7%-12% of the road vehicle fleet
- Stated Policies Scenario: reflects all existing policies, policy ambitions and targets that have been legislated for or announced by governments around the world
- Sustainable Development Scenario: all current net zero pledges are achieved in full and there are extensive efforts to realise near-term emissions reductions - scenario is consistent with limiting the global temperature rise to 1.65 °C (with a 50% probability)

### Recognising the lasting prominence of ICE vehicles and the implications for global transportation emissions

- Despite the expected growth of their market share, electric vehicles will continue to play a comparatively minor role when compared to ICE vehicles
- However, high production costs, consumer prices and range anxiety continue to hamper speed of adoption of BEVs (Battery Electric Vehicles)
- As such, global reliance on internal combustion engines is likely to persist for several decades to come
- At the same time, urgent action is required and most governments have set ambitious decarbonisation goals for 2030 and 2050
- Therefore, the development and deployment of Advanced Sustainable Fuels, in parallel to the continued roll-out of electrification is essential for meeting global decarbonisation goals

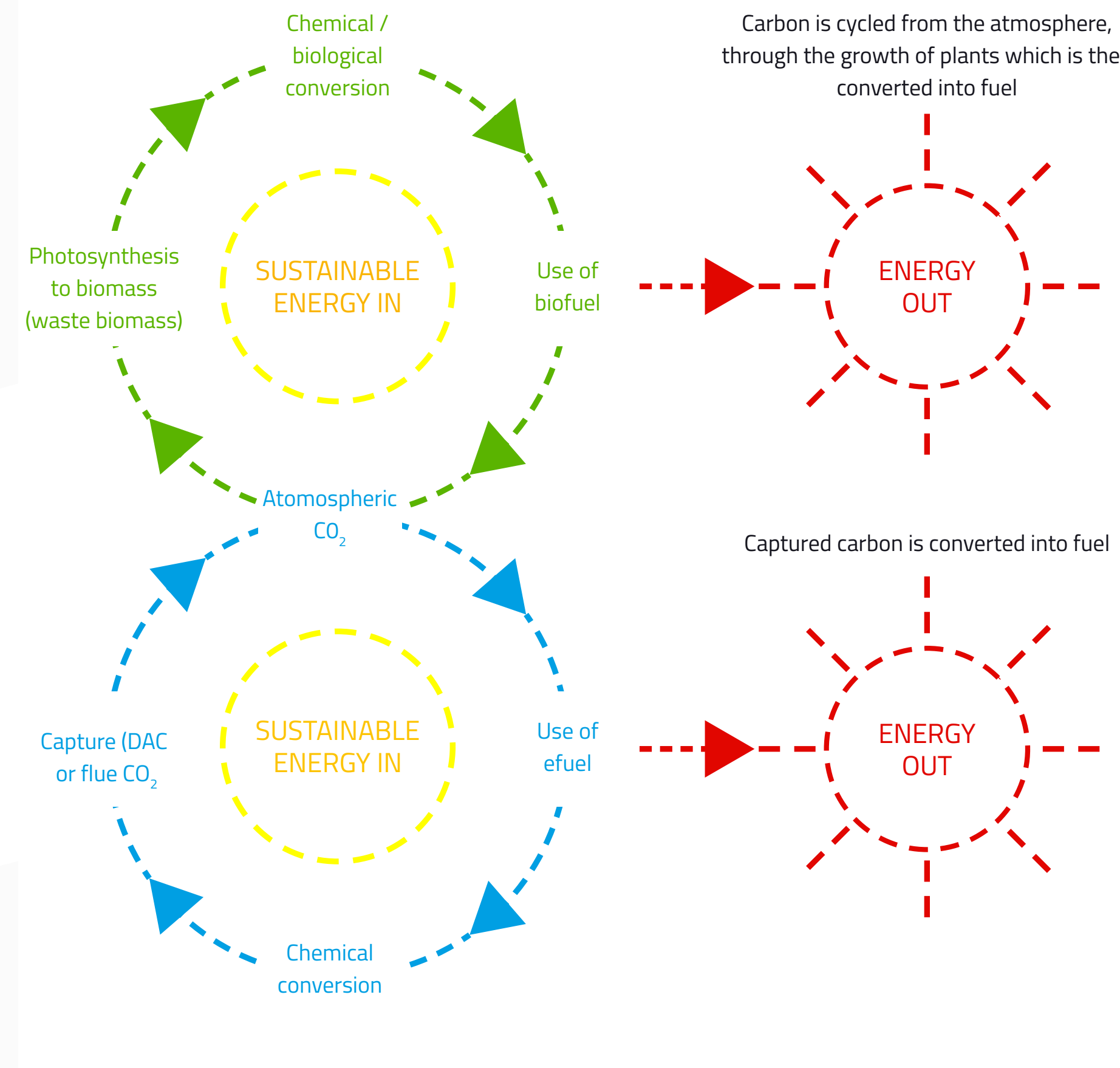
1. <https://iea.blob.core.windows.net/assets/ed5f4484-f556-4110-8c5c-4ede8bcba637/GlobalEVOutlook2021.pdf>



# Advanced Sustainable Fuels can be manufactured, via chemical conversion processes from either a carbon capture or non-food 'biomass'

Advanced Sustainable Fuels remove carbon from the atmosphere within its production, therefore offer a pathway to achieving net-zero carbon for transport

## How sustainable fuels are derived<sup>1</sup>



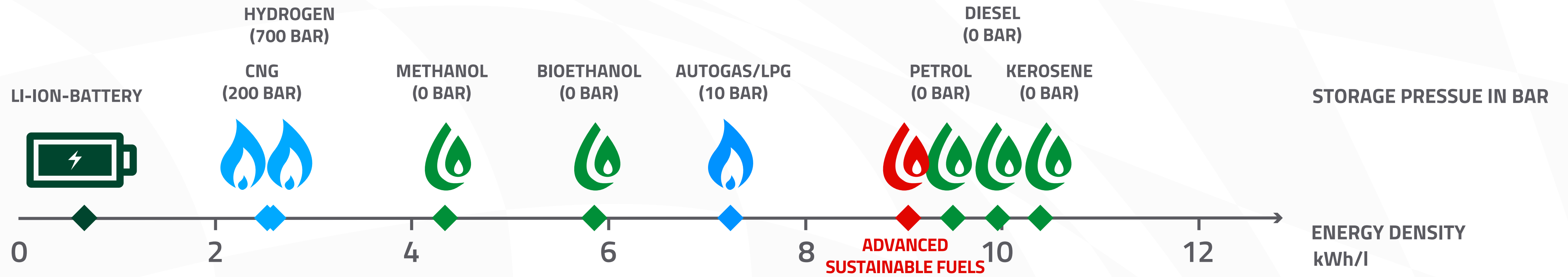
## Advantages of Advanced Sustainable (AS) Fuels

<b>Climate neutral combustion</b>	✓	No net GHG are produced as the fuel has been synthesised using carbon that has been removed from the atmosphere (TTW – Tank to Wheel)
<b>CO<sub>2</sub> reduction</b>	✓	When compared to fossil fuels, the main CO <sub>2</sub> reduction potential is ~ 85–96% (WTT – Wheel to Tank basis) or 70% (life-cycle analysis) <sup>2</sup>
<b>Drop-in capabilities</b>	✓	Sustainable fuels can be used within current existing ICEs, mitigating the need to manufacture new power conversion units
	✓	The fuel can be blended into existing fossil fuels which allows for smooth transition into mass production
<b>Storage and distribution</b>	✓	Does not require modification of existing infrastructure for distribution, storage and filling stations
	✓	Improved storage and distribution when compared to Hydrogen - Can be transported at room temperature and pressure
<b>Energy density</b>	✓	Sustainable fuels have a higher energy density when compared to batteries making them appropriate for a wide variety of sectors
<b>Does not compete with food supply</b>	✓	Advanced Sustainable Fuels developed by F1 will not use food crop, hence do not compete with food supply chain
<b>Provide economic transition away from fossil fuels</b>	✓	Increasing volumes of AS fuels mixed into fossil fuel for road use provide an economic pathway to fund investment in higher volume production as well as reduce road ICE carbon footprint sooner

Source: (1) <https://royalsociety.org/-/media/policy/projects/synthetic-fuels/synthetic-fuels-briefing.pdf> (2) <https://www.concawe.eu/wp-content/uploads/E-fuels-article.pdf>

Sustainable fuels are more energy dense than alternative energy sources such as electricity and hydrogen, therefore can be used across the whole transportation sector

### Energy density of a range of fuel options<sup>1</sup>



#### Lithium-ion batteries

- Despite lithium-ion batteries currently being the most energy dense batteries available<sup>2</sup>, they are far less energy dense than conventional and sustainable fuels
- For carbon intensive transportation segments (e.g. heavy goods vehicles, shipping and aviation), this is extremely challenging for battery technology due to the size and weight of the battery packs required

#### Hydrogen

- Hydrogen is difficult to store and transport and, even liquid hydrogen, has a relatively low volumetric energy density when compared to conventional and sustainable fuels
- The inefficiency of compression and/or refrigeration required for storage and transportation of hydrogen is a concern for widespread hydrogen adoption
- The weight of pressure vessels needed to contain high pressure hydrogen is much more than the weight of the hydrogen itself and creates a practical barrier
- The volume of hydrogen needed – even at high pressure is still too large for many applications

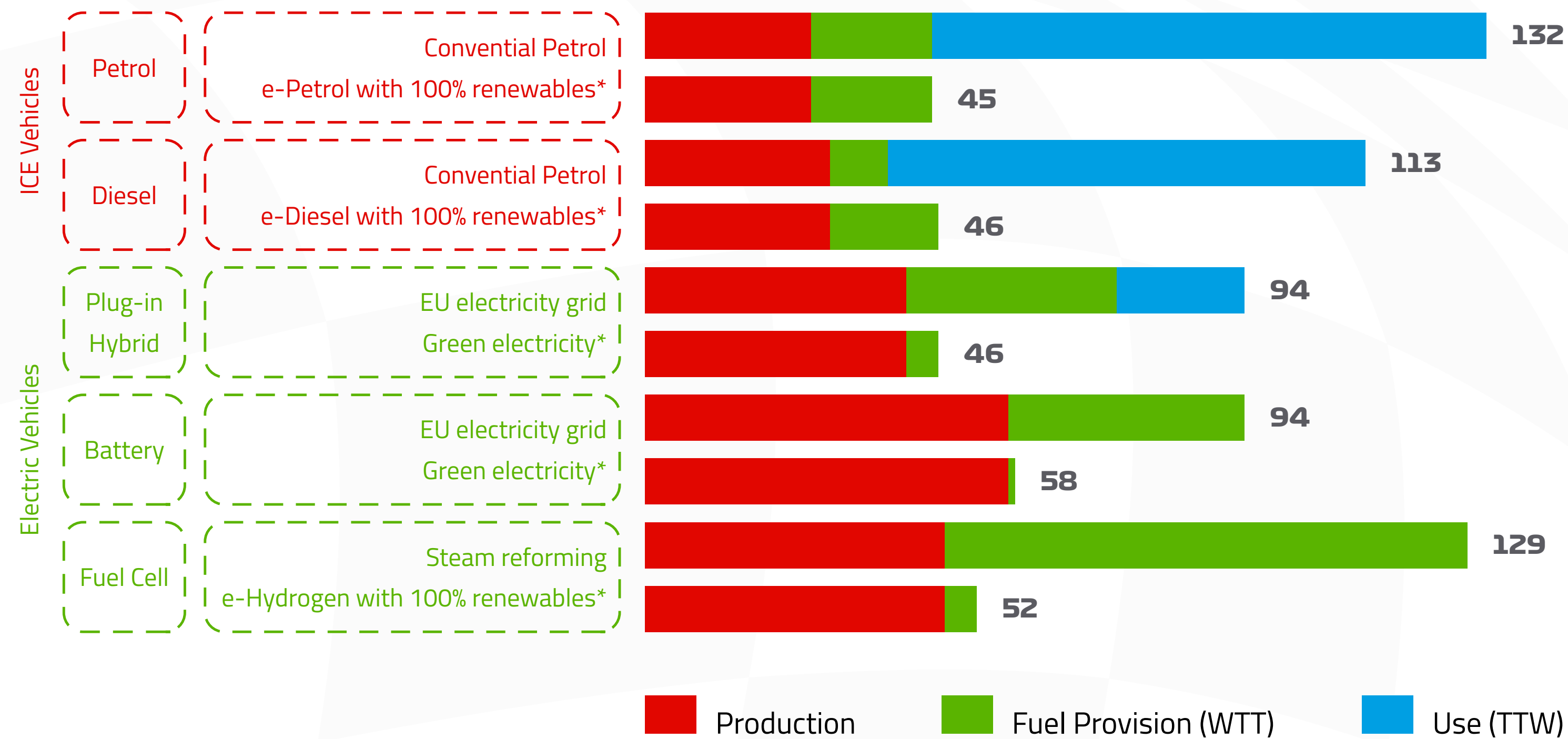
#### Sustainable fuels (biofuel and synthetic eFuel)

- Biofuels (bioethanol, methanol) have a higher energy density when compared to lithium-ion batteries, however they typically have a lower energy density than conventional fossil fuels (petrol, diesel, kerosene)
- Synthetic eFuels, on the other hand, can achieve similar energy density when they are produced with the same chemical composition of conventional fuels
- Sustainable fuels offer a medium to long-term transition pathway to decarbonisation by reducing fossil fuel use across the whole transportation sector

1. <https://www.efuel-alliance.eu/efuels> 2. <https://www.cei.washington.edu/education/science-of-solar/battery-technology/>

# When compared on a life cycle basis, internal combustion engine (ICE) vehicles running on Advanced Sustainable Fuels can produce lower greenhouse gas emissions than electric vehicles

## Life Cycle CO<sub>2</sub>e (g/km) of ICE and electric vehicles for different conventional and renewable fuels (in 2030)<sup>1</sup>



- In order to ensure that a product/technology is contributing towards the goal of decarbonisation, it must be evaluated on a life-cycle basis - quantifying the environmental impact over its lifespan
- Although electric vehicles produce zero emissions when in-use, there are high associated emissions with production - predominantly driven by manufacture of the battery pack
- While all ICE vehicles emit tailpipe emissions during use, unlike conventional fossil fuels that extract carbon from the ground and introduce it into the atmosphere, almost no new carbon is created when using Advanced Sustainable Fuels that capture existing carbon during production
- Taken altogether, analysis by the Institute of Mechanical Engineers suggests that the lifetime GHG emissions of ICE vehicles powered by Advanced Sustainable Fuels are comparable or potentially better than that of EVs

\*Carbon footprint for production will also be reduced; WTT = Wheel-To-Tank; TTW = Tank-To-Wheel

1. [https://www.imeche.org/docs/default-source/1-oscar/reports-policy-statements-and-documents/imeche-decarbonisation-report-final.pdf?sfvrsn=65c68712\\_2](https://www.imeche.org/docs/default-source/1-oscar/reports-policy-statements-and-documents/imeche-decarbonisation-report-final.pdf?sfvrsn=65c68712_2)

Sustainable fuels are a reality and a priority and the significant momentum in the adoption of synthetic fuels is supported by regulatory bodies and industry leaders

## Automotive Manufacturers

### Porsche

Porsche has partnered with a group of energy firms to develop a plant for the commercial production of synthetic fuels. The plant is set to be operational by 2022 and is aiming to be producing 55million litres of Synthetic fuel by 2024.

### Mazda

Mazda has become the first automotive manufacturer to join the eFuel Alliance, which brings together organisations and interested parties that support the goal of establishing and promoting CO<sub>2</sub>-neutral e-fuels and hydrogen as a credible and real contributor to reducing emissions in the transport sector.

### Audi

Audi has been working with its own partners on eFuels since 2009. The company has plans for a new pilot factory for the production of e-diesel and the facility will have a capacity of around 400,000 litres per year.

### Volkswagen (VW)

Bosch, Shell and VW have developed a low-carbon gasoline (Blue Gasoline) contains up to 33% renewables, ensuring a well-to-wheel reduction in carbon emissions of at least 20% per km driven.

### Toyota

Involved in the research of 2<sup>nd</sup> generation biofuels that do not rely on using food crops, making sure that the fuel developed achieves the performance quality motorists expect from conventional petrol and diesel.

## Regulatory

### **General Transport**

Within the proposed revision of the [Renewable Energy Directive \(RED\) II](#), the transport sector should aim to source 2.2% of its energy from advanced biofuels as well as 2.6% from non-biological renewable fuels (e.g. Synthetic eFuels) by 2030.

### **Aviation**

[The International Air Transport Association \(IATA\)](#), the trade association of the world's airlines, has approved a resolution for the global air transport industry to achieve net zero emissions by 2050. In order to achieve this, IATA has proposed a roadmap for Sustainable Aviation Fuels (SAF) to rise from 2% of the total fuel used by 2025, rising to 65% by 2050.

60 companies in the [World Economic Forum's Clean Skies for Tomorrow Coalition](#) – whose mission is to accelerate the deployment of SAF– have committed to power global aviation with 10% SAF by 2030.

The recently proposed [RefuelEU Aviation Regulation](#) has also been designed to support a swift transition from fossil fuels towards sustainable fuels in air transport.

### **Maritime**

A new [FuelEU Maritime proposal](#), to stimulate the uptake of sustainable maritime fuels and zero-emission marine propulsion technologies by setting a maximum limit on the greenhouse gas content of energy used and renewable and low-carbon fuel mix to be used.

## Sustainable Fuel Initiatives

### **Fuel Producers**

[Aramco](#) have partnered with Spanish Repsol to develop a 'zero emission' synthetic fuel plant near Bilbao

[ExxonMobil and Neste](#) have announced an agreement with Virgin Atlantic for the supply of 2.5m litres of SAF.

[Shell](#) has announced plans to build one of Europe's biggest biofuels facilities in the Netherlands, which will produce renewable diesel made from waste, in addition to SAF.

[Air bp](#) is working alongside airlines and airports around the world to deliver increasing volumes of SAF.

[Eni](#) has launched the production of SAF with the aim is to reach a production capacity of at least 500 thousand tonnes/year by 2030.

[Chevron and Gevo](#) have announced plans to build and operate one or more facilities to produce SAF.

***THANK YOU***